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Needs and Values Assessment Model for STAN

Surveillance and Targeting Acquisition Network to Support Special Forces

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Background

- Special Forces missions rely on covert operations
- During 1991 war with Iraq, ten of 12 SF missions were compromised
- Current global war on terrorism generated greater demand for SF deployments
- SF operations are characterized by joint or allied, dynamic collaboration of wide-ranging sensors, aircraft and personnel

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Analysis of STAN at NPS

- Throughout 1990's, SF community considered capabilities gaps
- Studies pointed to improving flexible command and control systems
- Technology evolved through Afghanistan operations in 2001-02
- SF officer enrolls at NPS, chartered with developing a prototype STAN capability
- Summer 2003, SEA students attack the problem

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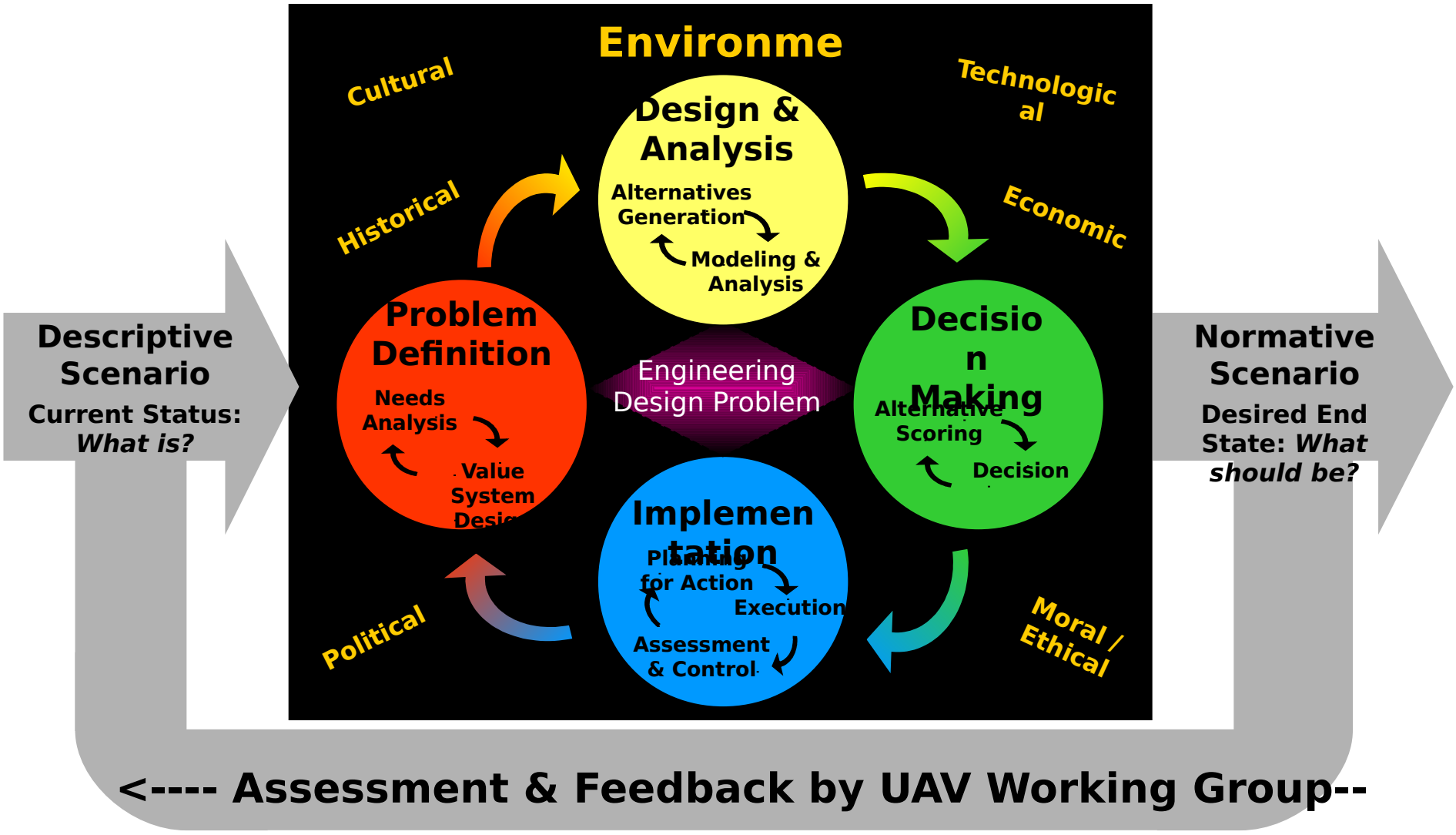
stems Engineering Design Proce



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Needs Analysis: Primitive Need

- Find the enemy
- Fix enemy location, identification & actions
- Access “accidental networks”
- Provide near real-time video display

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Questions Regarding STAN

- Is there a difference between what SF want and what they need?
- Would this capability benefit only SF or is there broader functionality?
- How should tactical needs best be reflected in design requirements?
- Who should develop this system?

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Role of Systems Engineering

- System of systems
  - Sensors, communications, weapons & humans
- Precedented subsystems
- Client wants an integrated solution
- Complex interactions and dynamic operating environment demand new approaches
  - ***How does the system affect the operation and how does the operation affect the system?***

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Systems Engineering & Design

- Define the problem
- Analyze the need
- Develop and prioritize a value system
- Generate alternatives
- Suggest models to analyze alternatives
- Enable a decision

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Needs Analysis: Refining the Primitive Need

- Identified stakeholders
  - Decision makers, sponsors, operators & developers
- Conducted interviews
- Decomposed system into subsystems
  - Specified interfaces with other systems as well
- Analyzed functional flow
- Specified inputs and outputs
  - Not all inputs are controllable
  - Some by-products are unintended

Effective Need

Provide a survivable network of tactical assets and collaboration on demand to support mission objectives, ensure mobility and focus operational understanding.

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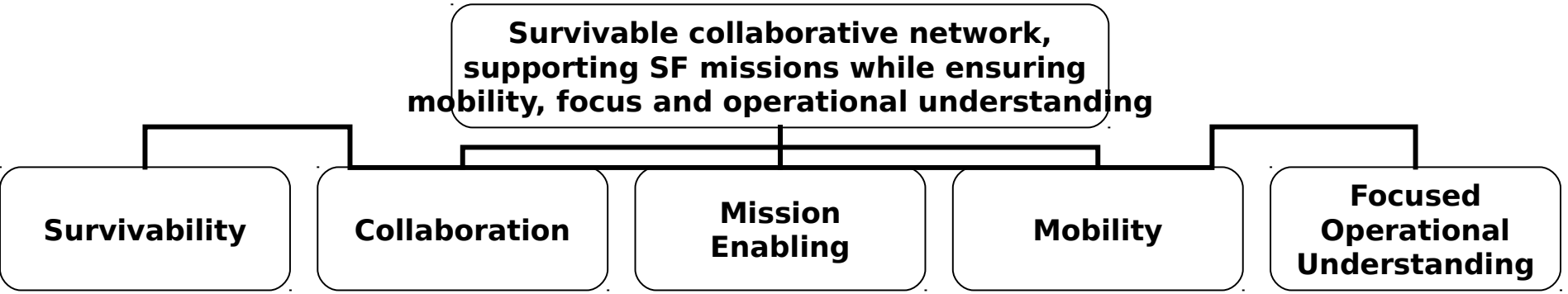
Top-level goals



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Survivability

- Pertains to entire system
  - Mission insurability through reduced signature
- Counterdetection of the system
  - Includes operators, sensors, platforms and communications
- Equipment reliability through design
- Enable improved time on station of forces
  - Prolongs time available for target prosecution
- Decrease risk associated with operators directly monitoring targets

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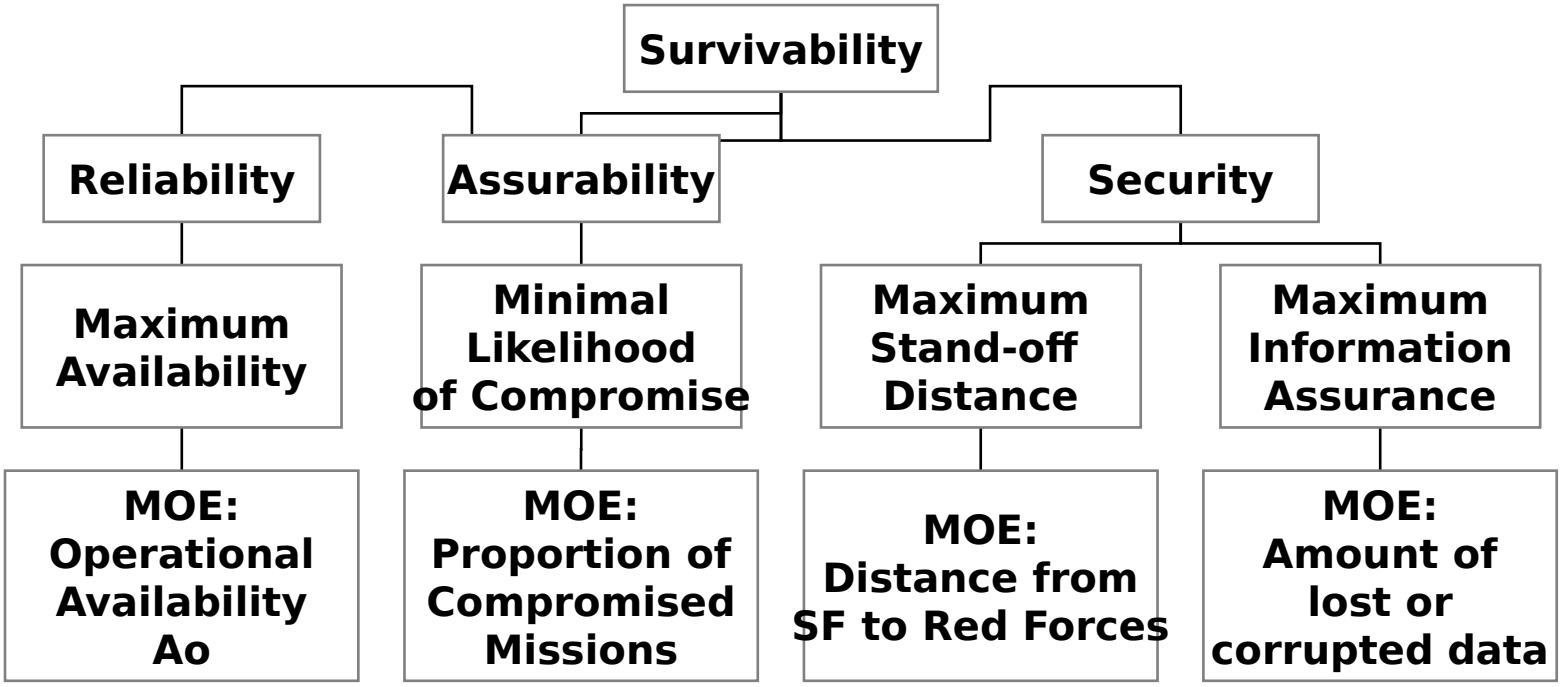
Survivability



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Collaboration

- Operators want near real-time video
- Technology enables shared applications
  - Make use of “coach’s clicker” capability
- Shared understanding is essence of common operating picture
- Increase in shared activity creates dynamic network loading
  - Requires adaptive management, increases overhead

Mission Enabling

- Enhance surveillance and targeting within bounded area of operations
  - Not a broad area reconnaissance system
  - Broad area reconnaissance will require greater numbers of sensors
- Focus is how to improve SF team performance across these missions
  - Use of unmanned sensors and network technology

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Assured Mobility

- Operators extremely averse to any increased burden
  - Prefer options that reduce rucksack requirements
  - Must be of significant improvement to be added
- Avoid increasing task loads and footprint
  - Design must not adversely affect mobility
  - Should SF teams be responsible for sustained UAV operations?

Focused Understanding

- Effective need points toward decreasing operational hazards
  - Blue-on-blue
  - Minimizing collateral damage
  - Knowing threat environment
- Drawback of increased information flow and reach-back connectivity
  - More nodes in the network may increase number of system failures
  - Actionable data becomes dilute
  - Prioritization of important information

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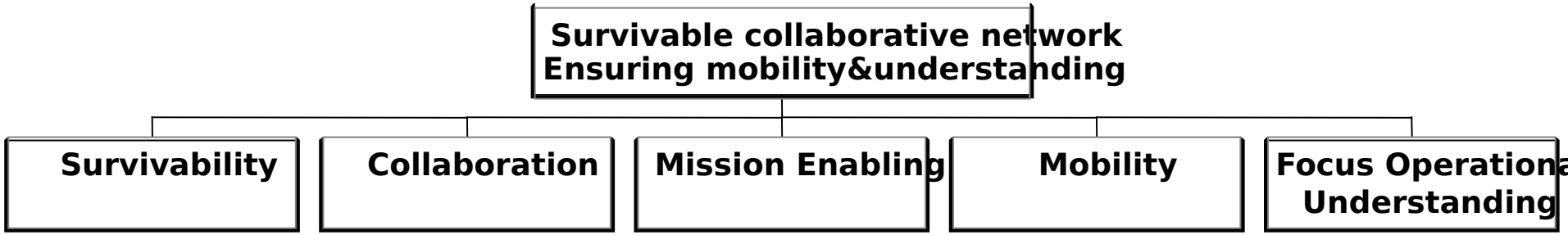
Weighting Functionality

Surveillance and Targeting Acquisition Network



- Value prioritization depends on stakeholder perspective
  - Operators emphasize survivability and mobility
  - Decision makers prioritize SF personnel on survivability, but also focus on mission (lethality) and collaboration
  - Engineers value use of technology for mission and operational understanding

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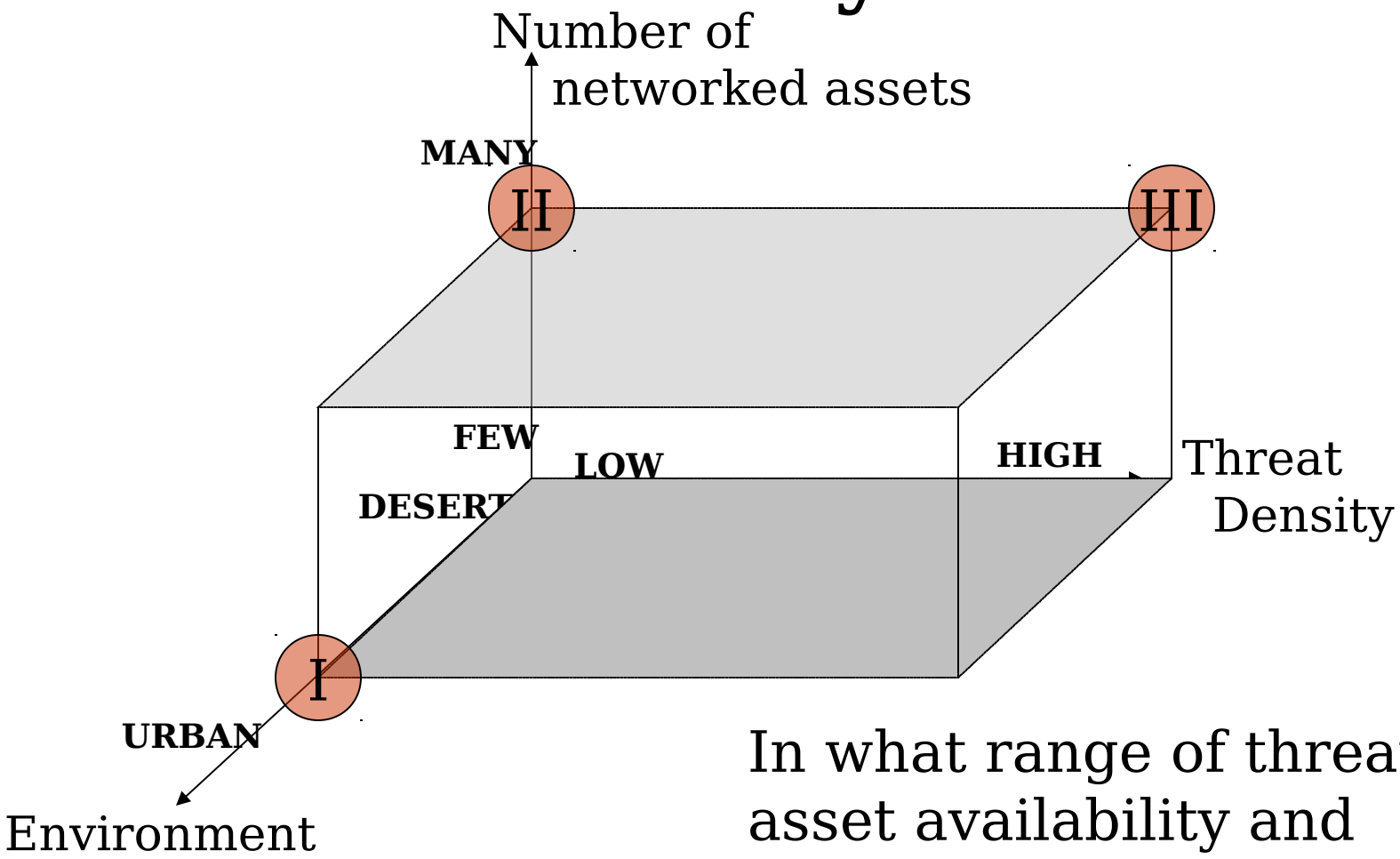
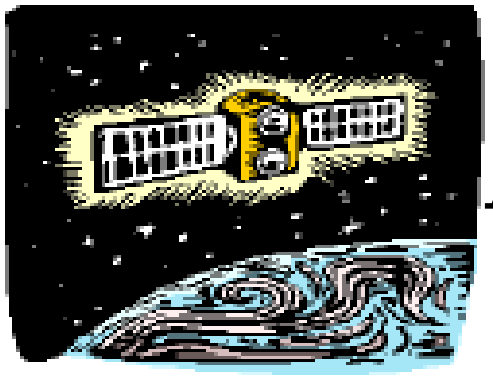
Aggregated Futures Analysis



In what range of threats, asset availability and tactical environment will STAN operate?



Design Alternatives

Who controls these?

UAV

Mission Support Site

Can everything be accomplished remotely?

ctical Operations Center

Reach-back

Where does data fusion occur?

Observation Point

Grou nd Senso rs

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Who controls these?

Alternatives

Can everything be accomplished remotely?

1. Human-Sensor System
2. Unattended-Remote System
3. Hybrid

Where does data fusion occur?

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Design Alternatives

Role/Responsibility		Operators	MSS	TOC
Functions	Situate			
	Observe			
	Control			
	Decide			
	Support			

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Design Alternatives Human-Sensor System

Role/Responsibility		Operators	MSS	TOC
Functions	Situate	✓		
	Observe	✓	✓	
	Control		✓	
	Decide		✓	
	Support			

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Design Alternatives Unattended/Remote System

Role/Responsibility		Operators	MSS	TOC
Functions	Situate			✓
	Observe			✓
	Control			✓
	Decide			✓
	Suppor			

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Design Alternatives Hybrid System

Role/Responsibility		Operators	MSS	TOC
Functions	Situate		✓	
	Observe		✓	
	Control		✓	✓
	Fuse			
	Support			

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Testing Alternatives

- Alternative technologies and operational designs undergoing research at NPS
  - Modeling, analysis and experimentation in place
- Trade-offs evident between network and sensor management
  - Competing goals for optimal topology
- Scenarios will vary from sparse terrain to urban setting and maritime environment

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Bottom Line

- SF-UAV-Sensor-Network operation forms a complex system of systems
- SEDP process helped define effective need from disparate, important operational desires
- Project demanded program engineering, process orientation and discovery

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Example Operation

Spring 2002

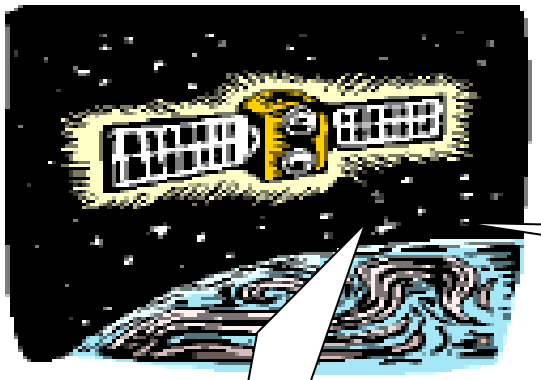
Conduct An Armed Reconnaissance to Apprehend Al Qaeda Commander

Assets

- **Special Forces A Teams**
- **240 Afghan Military Forces**
- **JSTARS, P-3, A-10s, F16s, Predator**

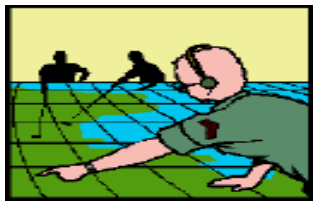
Possible suspect locations

- **Encampment**
- **Among civilians**



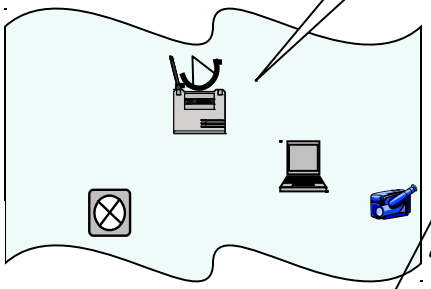
Mission Support Site

UAV



Tactical Operations Center

Reach-back



Sensors

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Stakeholder Analysis

- Decision makers
  - Principal Investigator, USASOC, NAVAIR
- Operators
  - SF ODA, SEAL Team, UV controllers
- Engineers
  - Display, network, air control
- Industry
  - SNC, AKSI, AOS, Inter4, et al.

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Interviews

- SE – SF roundtable discussion
  - Operators know what they want and are used to making the best of what they're issued (TTP)
- Regular discussions among NPS UAV working group
- Interactions during series of experiments

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Subsystem Decomposition

- Operator (human)
- Sensors
- Platforms
  - Manned and unmanned
  - Ground and airborne
- Network
- Interfaces
  - Hypothesis is whether the network enhances mission effectiveness – experimentation will tell
  - Operators cue sensors and sensors cue operators, too

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Surveillance and Targeting

- Sensors arrive in area of operations
  - Optimal location, positioning is not a given
- Assets conduct area search, detection
- When necessary, assets require control
  - Advisory, supervisory and positive
- Supporting a sensor grid requires effort
- Information display, interpretation and decision requires attention and focus

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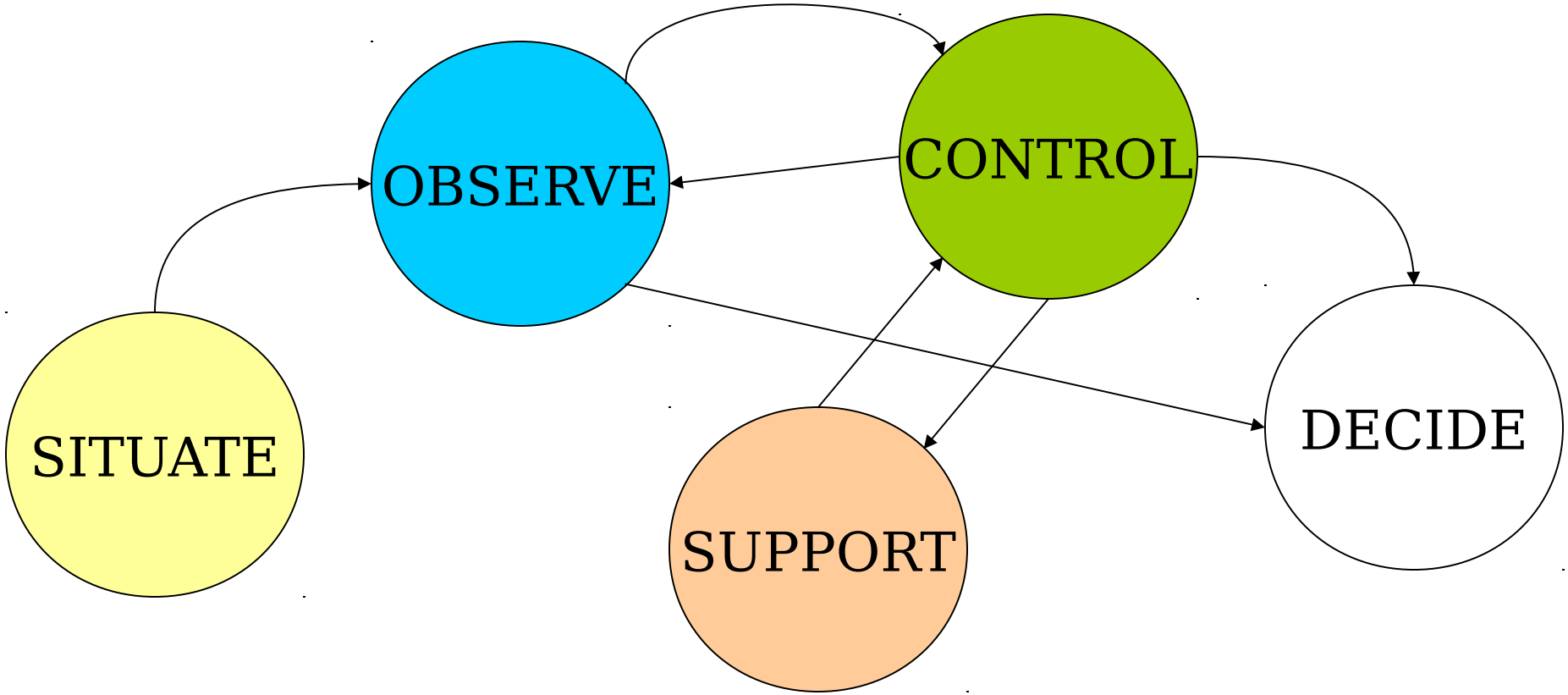
Functional Flow



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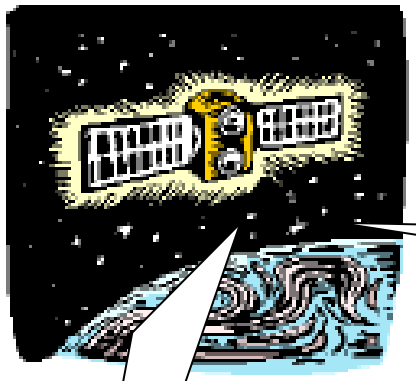
Inputs, Outputs & By-Products

- Controllable inputs
  - Forces, network participants, protocols
- Uncontrollable inputs
  - Target and non-target activity, network topology
- Outputs
  - Detection, identifying and targeting information
- By-products
  - Own-force signature (RF, audible) & footprint



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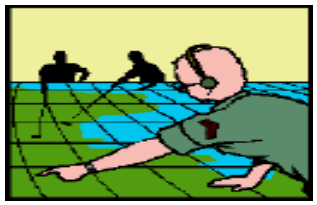

Tactical Operations Center

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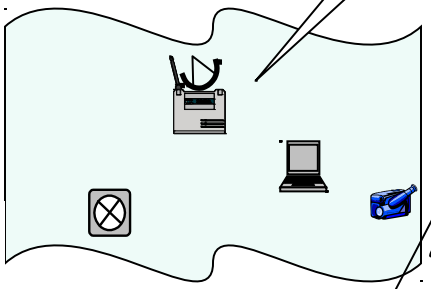

Sensors

Observation Point